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ABSTRACT

Economic segregation increased in the United States between 1970 and 1990. Three hypotheses suggest that this would affect low-income children's educational attainment. The political economy of school funding predicts that economically segregated school districts reduce the educational attainment of low-income children. Two other hypotheses emphasize the effect of inequality within neighborhoods. However, they produce opposite predictions about the effect of inequality on educational attainment. None of the hypotheses provide a firm prediction about the effect of economic segregation on overall educational attainment. This study combines Census data with data from the Panel Study of Income Dynamics to show that an increase in economic segregation between census tracts in the same state hardly changes overall educational attainment, but it exacerbates inequality between high-income and low-income children. With overall inequality held constant, changes in economic inequality within census tracts have little effect on low-income children's educational attainment. An appendix contains a description of the data and variables. (Contains 48 references.) (SM)

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August 7, 2001

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How Economic Segregation Affects Children's Educational Attainment

by Susan Mayer
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Abstract

Economic segregation increased in the United States between 1970 and 1990. Three hypotheses suggest that this would affect low-income children's educational attainment. The political economy of school funding and predicts that economically segregated school districts reduce the educational attainment of low-income children. Two other hypotheses emphasize the effect of inequality within neighborhoods. But they produce opposite predictions about the effect of economic segregation on educational attainment. None of the hypothesis provides a firm prediction about the effect of economic segregation on overall educational attainment. I combine Census data with data from the Panel Study of Income Dynamic to show that an increase in economic segregation between census tracts in the same state hardly changes overall educational attainment but it exacerbates inequality between high-income and low-income children. With overall inequality held constant changes in economic inequality within census tracts have little effect on low-income children's educational attainment.

Economic Segregation, and Children's Educational Attainment

Although it is well documented that households became more geographically segregated by income in the United States between 1970 and 1990 (Jargowsky 1996, 1997, Mayer 2001), many fewer studies try to assess the consequences of this increase. Several hypotheses suggest that economic segregation is related to the educational attainment of low-income children, but they provide different predictions about the direction of the effect.

One hypothesis emphasizes the political economy of school financing. It suggests economic segregation between school districts reduces low-income children's educational attainment. Two other hypotheses emphasize the effect of inequality within neighborhoods. One emphasizes the advantages of affluent neighbors to low-income children. It suggests that income inequality within neighborhoods raises children's educational attainment. The other emphasizes the liabilities of affluent neighbors. It suggests that income inequality within neighborhoods lowers children's educational attainment.

All three hypotheses also predict that economic segregation could increase affluent children's educational attainment. If the benefits of economic segregation to high-income children offsets the liabilities to low-income children, overall educational attainment would remain unchanged due to an increase in economic segregation. However, if increased economic segregation leads to more inequality in children's educational attainment, increases in economic segregation among parents would presumably result in more economic inequality in the next generation.

This paper estimates the effect of the growth in economic segregation on children's overall educational attainment, and on the educational attainment of low-income and high-income children. In doing so I separately estimate the effect of an increase in between neighborhood economic inequality and within neighborhood economic inequality on educational attainment. I focus entirely on the effect of economic segregation. As I discuss below racial and ethnic segregation are associated with economic segregation, but they are likely to have different effects on educational attainment.

Section I describes previous research related to the effect of economic segregation on educational attainment. Section II describes how I measure economic segregation. Section III describes the data and models that I use. Section IV presents the results and Section V provides conclusions.

I. Previous Research

Two research traditions provide relevant theoretical and empirical background concerning the effect of economic segregation on educational attainment. The first emphasizes local school financing and the second emphasizes neighborhood social composition.

School Finance. When schooling is locally financed, mean school district income can affect school spending and school quality, which in turn can affect educational outcomes (Benabou 1996, Fernandez and Rogerson 1996, de Bartolome 1990).[1] According to this model, as some

[1] The effect of school spending on educational outcomes is still hotly debated. Some reviews claim that neither school spending nor other school resources affect school achievement or other educational outcomes (Hanushek 1997). Other studies find that per pupil spending has a positive effect on educational outcomes (Hedges et al. 1992, Ferguson and Ladd 1996) and future earnings (Card and Krueger 1996).

school districts get richer and others get poorer, disparities in school funding increase. As low-income children become concentrated in neighborhoods in which few resources are spent on schooling, their educational outcomes suffer. Of course, this sorting would also concentrate high-income children in high-income neighborhoods that can spend a lot on schooling. This could increase the educational attainment of high-income children. If school quality is a linear function of school spending and the return to schooling is the same for high and low-income children, economic segregation (and the resulting disparities in school spending) would improve educational outcomes among high-income children, off-setting the decline among low-income children. This would leave mean educational attainment unchanged but increase inequality of educational attainment between high and low-income children.

Some evidence suggests that when states have reformed school funding to reduced reliance on local taxes and limit local tax and spending discretion for schools, funding for schools became somewhat more equal (Evans, Murray and Schwab 1997, Hoxby forthcoming, and Downes and Figlio 1997) as did test scores (Card and Payne 1997, Downes and Figlio 1997). This suggests that disparities in local school tax policy affects school spending, which might also affect children's schooling.

Neighborhood Effects. Sociologists who study neighborhood effects have been less interested in school finance and more interested in the benefits that affluent residents might generate for their neighbors (Wilson 1987, Durlauf 1996, Jencks and Mayer 1990).[2] These benefits could derive from better role models and more useful social networks (Wilson 1987), as well as from more effective neighborhood monitoring (Sampson and Laub 1994). Such mechanisms imply that both rich and poor children benefit from affluent neighbors. This implies that mean neighborhood income affects children's educational attainment independent of a family's own income because mean neighborhood income is a proxy for role models and monitors. It also implies that given the same mean neighborhood income, children in economically unequal neighborhoods fare better than children in more economically equal neighborhoods.

However, some families may see advantaged neighbors as a disadvantage. When disadvantaged children must compete with advantaged children for good grades, good jobs, or social status, they are more likely to lose out (Davis 1966, Jencks and Mayer 1990). In addition, relative deprivation theory predicts that when the poor compare themselves to the rich, this can lead to unhappiness, stress, and alienation (Merton and Kitt 1950, Davis 1959, Runciman 1966, Williams 1975). The relative deprivation and competition theories suggests that an increase in within-neighborhood income inequality would hurt children's educational attainment because it would exacerbate harmful effects of interpersonal comparisons.

It is possible that advantaged neighbors are both an advantage and a disadvantage. If the benefits of such neighbors offset the disadvantaged, we would observe no net effect of within neighborhood inequality. I know of no studies that estimate the effect of neighborhood economic inequality on educational attainment. Several studies find that having advantaged neighbors is associated with higher educational attainment among children (Halpern-Felsher et al. 1997, Connell and Halpern-Felsher 1997, Brooks-Gunn et al. 1993, Clark 1992, Crane 1991,

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[2] See Jencks and Mayer (1990), Ellen and Turner (1997), and Gephart (1997) for reviews of this research.

and Mayer 1991).[3] But these studies do not distinguish between the effect of higher mean neighborhood income and greater income inequality within neighborhoods.

Estimates of the effect of neighborhood economic conditions have many well-known estimation problems (Duncan et al. 1997, Tienda 1991, Jencks and Mayer 1990). For example, if unmeasured parental characteristics that lead apparently similar parents to choose different neighborhoods also have different effects on children, as seems likely, the estimated effect of neighborhood characteristics are likely to be biased. However, even an unbiased estimate of the effect of a neighborhood's mean income would tell us little about the effect of economic segregation on educational attainment. The effect of segregation depends on the difference between the effect of affluent neighbors on poor children and the effect of affluent neighbors on affluent children. If the relationship between neighborhood mean income and educational attainment is linear, so that an increase in mean income raises educational attainment by the same amount in low-income and high-income neighborhood, an increase in the variance of mean neighborhood income will not affect overall educational attainment. Instead, the increase in educational attainment in affluent neighborhoods will exactly offset the decrease in low-income neighborhoods. If an increase in mean neighborhood income improves low-income children's educational attainment more than it improves high-income children's educational attainment, then an increase in the variance of mean neighborhood income will hurt poor children more than it helps rich children and overall educational attainment will decline when segregation increases. This is because, as I show below, with the overall variance constant, an increase in the between-neighborhood income variance results in a decline in the within-neighborhood income variance, which in turn results in more homogeneously rich and poor neighborhoods.

I am aware of only one study that estimates the effect of economic segregation on educational outcomes. In a study that mainly focuses on racial segregation, Cutler and Glaeser (1997) find that economic segregation has little effect on white MSA residents' chances of graduating from high school or college.

II. Measuring Economic Segregation

Sociologists have developed many possible measures of economic segregation.[4] Because most of these were originally developed to assess racial or ethnic segregation, they were developed for categorical variables. The most commonly used measures are the "exposure index," which gives the probability that members of one group live in the same neighborhood as members of another group, and the "index of dissimilarity," which gives the percent of residents with a particular characteristic who would have to move for the group to be equally represented in all neighborhoods.

Massey and Eggers (1990) were the first sociologists to analyze trends in economic segregation. They classified families into four income classes and computed an average index of dissimilarity for these groups.[5] They found that between 1970 and 1980 inter-class dissimilarity

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[3] An exception is Evans et al. (1992) who find that the effect of school social composition on schooling outcomes is largely spurious.

[4] See White (1987) and James (1986) for reviews of measures of segregation.

[5] The index of dissimilarity is calculated as follows:

$$.5 \sum_{i=1}^{N} \left| (x_n / X_a) - (y_n / Y_a) \right|$$

declined for whites, Asians, and Hispanics, but increased for blacks. This implies that overall social class (economic) segregation did not change much between 1970 and 1980.

Jargowsky (1996) criticized Massey and Eggers' measure of segregation on two main grounds. First, because income is continuous, categorizing it into discrete categories throws away potentially valuable information. Second, because the income cut-offs that Massey and Eggers use fall at different points in the income distribution for 1970 and 1980, changes in the underlying income distribution could make it appear as though segregation changed, even when the spatial distribution of income did not change. Following Farley (1977) Jargowsky (1996) used the "neighborhood sorting index" to measure segregation. This measure decomposes the total variance of household income for an area such as a state or metropolitan area (σ_t^2) into two additive components, a between-neighborhood component (σ_{bn}^2) and a within-neighborhood component (σ_{wn}^2). This yields the identity:

$$\sigma_t^2 = \sigma_{bn}^2 + \sigma_{wn}^2 \qquad (1)$$

The ratio of the between-neighborhood variance to the total variance (σ_{bn}^2/σ_t^2) is the "neighborhood sorting index." In the absence of economic segregation, all areas have the same mean income and $\sigma_{bn}^2/\sigma_t^2 = 0$. With complete economic segregation, there is no income variation within geographic areas and $\sigma_{bn}^2/\sigma_t^2 = 1$. Using the neighborhood sorting index, Jargowsky (1996) shows that income segregation increased for whites, African Americans, and Hispanics both between 1970 and 1980 and between 1980 and 1990.

Equation 1 shows that if the distribution of household income in an area is fixed, factors that reduce the *between*-neighborhood variance (the variance of neighborhoods' mean income) will necessarily increase the *within*-neighborhood variance of household income. Thus if we assume a given overall level of inequality, the claim that residential segregation by income hurts children's well-being must also be a claim that inequality within neighborhoods does less harm than inequality between neighborhoods. However, if inequality increases, as it did beginning the 1970s (Morris and Western 1999, Karoly 1993, Lichter and Eggebeen 1993), an increase in inequality between neighborhoods could be accompanied by an increase, decrease, or no change in inequality within neighborhoods. The next section shows that the distinction between economic inequality between neighborhoods and within neighborhoods is important both theoretically and empirically.

III. Data and Methods.

In order to measure economic segregation, one must decide what geographic units to compare. Ideally one should select geographic units that are theoretically relevant to the outcome of interest. Massey and Eggers (1990) and Jargowsky (1996) estimate changes in economic segregation between census tracts in Metropolitan Statistical Areas (MSA). The choice of MSAs is motivated both by a tradition of research on cities and by the notion that MSAs approximate labor markets, but not by a strong theory suggesting that the geographical distribution of income in MSAs is more important than the geographical distribution of income in counties, states, or the nation as a whole. I estimate the effect of economic segregation in states on educational attainment. I use states for three main reasons. States are relevant political

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where x_i and y_i are the number of x or y members in neighborhood n and X and Y are the number in area a.

jurisdictions for educational outcomes. A typical American state provides about half the funding for its public schools. Local school districts provide most of the rest. MSAs are not political jurisdictions, and in fact they often cross important political boundaries. Second, I analyze the relationship between changes over time in the level of segregation and changes and educational attainment. MSA borders have changed over time, but state borders have not, which makes states both easier to use and more consistent. Third, everyone living in the United States lives in a state except residents of the District of Columbia. The proportion of the population living in MSAs increased from 68.6 percent in 1970 to 74.8 percent in 1980 and 79.6 percent in 1990.[6] Thus trends in economic segregation that rely on MSAs include varying proportions of the population.

Because most Americans do live in MSAs, the level of segregation in states and MSAs is highly correlated. Geographical differences in segregation are the same for states and MSAs. For example, both Jargowsky (1996) and Massey and Denton (1993) show that economic segregation by census tracts within MSAs is greater in the north than in the south. As I show below economic segregation between census tracts in states is also greater in the north than in the south. Thus it is reasonable to expect that the results in this paper for segregation in states would also hold for segregation in MSAs.

Nor does theory tell us what smaller geographic units to consider. If one were mainly interested in school financing, one might want to assess the effect of economic segregation between school districts within the same state. But if interpersonal comparisons involving relative deprivation, competition or role models influence children's educational attainment, and if children are more likely to make such comparisons with people in their immediate neighborhoods, it makes more sense to compare either elementary school attendance areas or census tracts. Data on elementary school attendance areas are not available. I therefore focus on census tracts, which typically have about 500 children aged five to thirteen. I estimate the effect of both segregation between school districts in the same state and segregation between census tracts in the same state on children's educational attainment. Because there was little substantive difference in the estimates, I mainly report the estimates for census tracts. However, I also report the relevant results for school districts.

My measures of state characteristics come from the 1970 1 percent Public Use Micro Sample (PUMS) of census data and from the 1980 and 1990 5 percent PUMS. I use the PUMS data to estimate the dispersion of household income in each state in 1970, 1980 and 1990. I then estimate the level of economic segregation between census tracts in each state for these same years.

To estimate the components of variance in equation 1, I calculate the total variance of household income for each state from PUMS data and calculate mean income for each census tract in the state using the STF4 and STF5 Census files.[7] I weight each tract mean by the population of the tract. The variance of the weighted means is the variance of household income between census tracts. To get the within tract variance I subtract the between tract variance from the total variance of household income in the state. I compute the within-tract variance and

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[6] Statistical Abstract of the United States 1997, Table 40.

[7] Not all the geographic area of states fall into census tracts. See the Appendix for a description of how I handle areas that were untracted in a year.

between-tract variance of income for each state in 1970, 1980 and 1990. I use linear interpolation to get estimates for the years between censuses.[8]

States vary considerably in the degree to which they are segregated. In 1990 the most economically segregated state was Illinois, where 52 percent of the income variance was between census tracts. Illinois was followed by Texas and Virginia where 42 percent of the variance was between census tracts. The least economically segregated states tend to be in the South. In both Arkansas and Mississippi less than 15 percent of the income variance was between tracts in 1990.[9]

The degree of economic heterogeneity within a typical census tract varies substantially by state. A common measure of inequality is the coefficient of variation (CV), which is equal to $\sigma_{ta}/\overline{X}_a$, where $\overline{X}_a$ is the area mean income and σ_{ta} is the standard deviation of income. In 1990 in Arkansas, Louisiana, Mississippi, and West Virginia the mean CV for income within a census tract exceeded .80. In Connecticut, Illinois, Maryland, New Jersey and Virginia the mean was less than .60. Most other states in the Upper Midwest and Northeast, including New York, Michigan, and Pennsylvania, had within-tract CVs for around .63 in 1990.

Because many adults no longer live in the state where they were raised, using economic segregation in a state to predict the educational attainment of the adults in the state could lead to serious errors. I therefore use data from the Panel Study of Income Dynamics (PSID) to estimate the effect of state economic segregation measured when children were fourteen years old on children's eventual years of schooling. Children in my sample were fourteen years old between 1970 and 1984. I measure years of schooling when respondents were twenty-three years old. I measure family background characteristics (described below) when children were twelve to fourteen years old. My PSID sample includes 3,240 respondents who were in the data set both when they were twelve to fourteen years old and when they were twenty-three years old. A full description of the data and the variables appears in the Appendix.

The most straightforward way to estimate the effect of economic segregation (S) in state s on child i's educational attainment (E) might be to estimate:

$$E_{is} = \alpha + \beta_s S_s + \varepsilon_{is} \qquad (2)$$

But equation 3 has several problems. First, as I have noted, it is useful to separate the effect of inequality within neighborhoods from the effect of inequality between neighborhoods. To do this we need to separate the components of economic segregation and include a measure of state mean income ($\overline{X}_s$):

$$E_{is} = \alpha + \beta_w \sigma_{ws}^2 + \beta_b \sigma_{bs}^2 + \overline{X}_s + \varepsilon_{is} \qquad (3)$$

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[8] To the extent that linear interpolation introduces error in the measurement of state economic segregation, it is likely to result in downwardly biased estimates of the effect of segregation.

[9] The least economically segregated MSAs are also in the South. See Figure 1 in Jargowsky (1996) and Table 4.1 in Massey and Denton (1993).

With mean state income controlled, the total variance of income is a measure of inequality in the state. Thus β_w is the effect of inequality between census tracts with the overall level of economic inequality held constant.

Many of the factors that cause one state to be more segregated than another might also affect educational attainment. For example, a state's racial diversity might be correlated with both economic segregation and educational attainment. To address the problem of omitted state variables, I control dummy variables for the Northeast, South, and Midwest regions. (The West is omitted.) This controls characteristics of the region that remain unchanged over the period of observation. I also experimented with controlling state dummy variables. This strategy has the advantage of controlling all invariant characteristics of states, but it has three important disadvantages. First, it can magnify measurement error in independent variables, including the measure of segregation, which would downwardly bias the estimated effects. Second, if the lag structure of the model is not correctly specified, this too can result in downwardly biased estimates of the effect of segregation. Third, including state dummy variables greatly reduces the degrees of freedom available to estimate the model, increasing the standard errors of the estimates. Nonetheless I report the sensitivity of my conclusions controlling state rather than region dummy variables.

I control several characteristics of states that have changed over time and may affect levels of segregation. These include state mean income, the percent of state residents who are African American and the percent who are Hispanic. I also control year dummy variables to account for the secular national trend in educational attainment. With both region and year dummy variables, variation in segregation derives from a combination of changes in segregation within states over time and differences in segregation among states in the same region. These are all measured in the year a child was fourteen years old. I also control a set of exogenous state-level determinants of economic segregation that are likely to affect children's years of schooling. These are described in the next section. With fixed effects and control variables the model becomes:

$$E_{ist} = \beta_0 + \beta_w \sigma_{wst\text{-}10}^2 + \beta_{bs} \sigma_{bst\text{-}10}^2 + \beta_x \overline{X}_{s,\,t\text{-}10} + \beta_z Z'_{st\text{-}10} + \gamma_r + \gamma_t + \varepsilon_{ist} \qquad (4)$$

where γ_r is a set of four region dummy variables and γ_t is a set of year dummy variables. The subscript t-10 indicates that the variable was measured ten years before educational attainment was measured (at age twenty-three). In this model Z' represents a vector of exogenous state characteristics that may have changed over time including racial composition, and other variables discussed below.

In equation 4 β_w is the effect of living in a state with more economically heterogeneous census tracts, controlling inequality between tracts. Similarly, β_b is the effect of living in a state with more inequality between census tracts controlling economic inequality within tracts. If economic segregation affects educational attainment, β_b will differ from β_w. If $\beta_b > \beta_w$ inequality between tracts is more important to children's educational attainment than inequality within tracts. If $\beta_b < \beta_w$, inequality within tracts is more important than inequality between tracts. If only the overall level of inequality in a state matters, β_b will not differ significantly from β_w.

IV. Results

Model 1 in Table 1 shows that the effect of the between-tract income variance on years of schooling is positive and statistically significant at the .05 level. The effect of the within-tract income variance is also positive and statistically significant. These effects are roughly equal and not significantly different from one another at the .10 level.[10] Thus a state's level of economic inequality but not its level of economic segregation between census tracts affects children's educational attainment. Economic heterogeneity within neighborhoods might improve children's educational attainment, but no more than economic heterogeneity between neighborhoods. The sum of the within-tract variance and between-tract variance is equal to the total variance in a state. With mean income controlled, the total income variance is a measure of economic inequality. The combined effect of the within-tract variance and the between-tract variance is statistically significant at the .05 level. Thus we can conclude that children who live in economically unequal states get more years of schooling that children living in economically equal states (Mayer forthcoming). The full results for this and other models are shown in Appendix Table A2.

If the level of inequality in a state does not change, an increase in σ_b^2 must be accompanied by the same decrease in σ_w^2. Thus the difference between β_b and β_w is the net effect of a one-point increase in the variance of mean neighborhood income on educational attainment when overall inequality is constant. This difference is shown in the third column of Table 1. To put this difference in perspective, the standard deviation of the variance of mean tract income is .118. Thus according to these results, a one standard deviation increase in the variance of mean tract income is associated with a .229*.118 = .027 year increase in educational attainment.

In Model 2 of Table 1 I control two variables that have changed over time and are arguably exogenous sources of variation in the overall level of economic inequality in a state. By affecting a state's total income variance, they also affect the level of variance within and between neighborhoods. These are the state unemployment rate and the state wage returns to schooling. Both are measured in the year a child was fourteen years old. Among states with the same mean income, those with high levels of unemployment are likely to have more inequality because unemployment disproportionately reduces the income of less affluent state residents.

One reason that inequality increased between 1970 and 1990 is that the returns to schooling increased (Murphy and Welch 1992, 1993; Juhn et al. 1993).[11] Because higher returns increase the incentive for children to stay in school, we expect educational attainment to increase when economic inequality increases. My measure of returns to schooling is the average effect of an extra year of schooling on log wages in a given state and year, estimated for workers aged 18 to 65. I estimate the effect of state returns to schooling when a child was fourteen years old on his or her eventual educational attainment.[12]

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[10] I test the statistical significance of the difference between coefficients using a Wald test.

[11] Rising returns to schooling is not the main source of inequality growth. The within-education group variance of income rose almost as fast as the between-group variance of income (Juhn et al. 1993, Karoly 1993), and educational attainment accounts for only 15-20 percent of the variance in income initially.

[12] I use returns when a child was age fourteen rather than returns at a later age for two reasons. First, the decision about how much schooling to get is intertwined with decisions about what to study: a student who does not expect to attend college often makes decisions about what to study in high school that make college attendance very difficult.

If these characteristics affect a state's level of economic inequality but not the geographical distribution of income, controlling them will reduce the effect of within-tract income variance and between-tract income variance by about the same amount. Model 2 in Table 1 shows that adding these variables reduces the effect of within-tract variance somewhat more than the effect of between tract variance. However, the difference between β_b and β_w remains small and statistically insignificant.

If parental characteristics that affect children's schooling also affect their choice of a state within a region, omitting controls for these characteristics could bias the estimated effect of economic segregation. In Model 3 I control the logarithm of average family income when a child was twelve to fourteen years old, parental education, and the child's race. The logarithm of family income can be a mechanism through which inequality affects children's educational attainment. If the relationship between educational attainment and parental income is linear, then when the rich gain a dollar and the poor lose a dollar, the educational attainment of the rich will increase by exactly as much as the educational attainment of the poor decreases, leaving the mean unchanged. However, if a 1 percent increase in income generates the same absolute increment in educational attainment, regardless of whether income is initially high or low, the relationship between the log of parental income and children's schooling will be linear. Then if all else is equal a costless redistribution of income from richer to poorer households will increase children's mean educational attainment, because shifting a dollar from the rich to the poor increases the education of poor children by a larger percentage than it decreases the education of rich children. If this mechanism accounts for some of the effect of inequality but parental income is not related to economic segregation, controlling the log of family income will reduce the effect of the within-tract and between-tract income variance by about the same amount. If higher income families live in states that are more segregated than lower income families, then the change in β_b will differ from the change in β_w when family income is controlled.

As Model 3 of Table 1 shows, controlling family background factors reduces the effect of both the within-tract income variance and the between-tract income variance and both effects become statistically significant. Consequently, even though the difference between β_w and β_b increases, it remains statistically insignificant.

In Table 1 no model produces a statistically significant difference between β_b and β_w. In all models both β_b and β_w are positive and jointly significant at at least the .10 level. From this we can conclude that a state's level of inequality but not its level of economic segregation increases children's educational attainment.

Poor Children. Table 1 describes the average effect of economic segregation for all children, rich and poor. The fact that the overall effect of economic segregation is small is consistent either with the hypothesis that neighbor's income does not matter or the hypothesis that the benefits to rich children from living near other rich children roughly offset the costs to poor children of living near other poor children. To distinguish between these possibilities, I estimate separate models for high and low-income children.

"High-income" children are those in the top half of the income distribution. "Low-income" children are those in the bottom half of the income distribution. Dividing the sample at the mid-point allows all variables to interact with household income in a way that is easy to

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Second, I assume that the rate of return to school often affects individual enrollment decisions indirectly, by affecting the way "significant others" value education. These indirect influences are likely to mean that current attitudes reflect past as well as current returns.

interpret and preserves enough high and low-income cases for a meaningful analysis. Other divisions of the sample, such as quartiles, provide qualitatively similar results but with larger standard errors. A model that interacts household income with all the relevant variables is difficult to interpret and also results in very large standard errors. Dividing the sample in half is instructive even though it may not capture all the nuances of the effect of economic segregation at different parts of the income distribution.

Model 1 in Table 2 shows that the effect of between-tract income variance is large, positive, and statistically significant for high-income children. The effect is smaller, negative, and not statistically significant for low-income children. The effect of within-tract income variance is positive and statistically significant for high-income children, but very small, negative, and statistically insignificant for low-income children. The difference between β_b and β_w is positive for high-income children and negative for low-income children but not statistically significant at the .10 level for either high or low-income children.

In Model 2, which controls the state unemployment rate and the state returns to schooling, the effect of the between-tract variance is large positive, and statistically significant and the effect of the within-tract income variance is smaller and statistically insignificant for high-income children. The effect of the between-tract variance is large, negative and statistically significant and the effect of the within-tract variance is very small and statistically insignificant for low-income children. The effect of between-tract variance is significantly greater than the effect of the within-tract variance (at the .10 level) for both high and low-income children. From this we can conclude that with overall inequality held constant an increase in economic segregation between census tracts is associated with an increase in high-income children's educational attainment and a reduction in low-income children's educational attainment. Model 3 shows that adding a child's own family background characteristics strengthens this conclusion.

Model 3 in Table 2 suggests that if overall inequality in a state stays the same, a one standard deviation increase in the between-tract income variance (.118) would increase high-income children's schooling by 2.701*.118 = .319 years. The same increase would reduce low-income children's schooling by –2.200*.118 = -.260 years. These effects roughly cancel one another, which is why Model 3 in Table 1 showed no overall affect of economic segregation on children's educational attainment. This result suggests that this increase in economic segregation would increase the gap in educational attainment between high and low-income students by .579 years. In this example, income inequality in the state does not change but economic segregation does. We can also simulate what would happen if income inequality changes.

Imagine that the total income variance in a state increases by one standard deviation (.205). If this increase were entirely distributed within tracts (so that within-tract but not between-tract inequality increased), high-income children's educational attainment would increase by 2.037(.205) = .418 years, while low-income children's educational attainment would hardly change at all. Thus overall educational attainment would increase and the gap between high and low-income children would increase by about .418 years. If instead all the increase in inequality were distributed between tracts (so that the variance of mean tract income increased) the educational attainment of high-income children would increase by 3.561(.205)= .730 years, while the educational attainment of low-income children would decline by -2.435 (.205) = - .499 years. Thus overall educational attainment would increase by .730-.499 = .231 years, but the gap between high and low-income children's educational attainment would increase by 1.229 years.

From this we can draw three conclusions. First, an increase in economic segregation has little affect on overall educational attainment. Second, an increase in economic segregation

exacerbates differences in educational attainment between high and low-income children. Third, an increase in economic inequality that is distributed between census tracts increases the gap in educational attainment between high and low-income children much more than an increase in inequality that is distributed within neighborhoods.

Sensitivity Test. Because dividing the sample at the median family income is arbitrary, I re-estimated Model 3 for the bottom fifth of the income distribution. This is shown in the last row of Table 2. The results suggest that economic segregation may hurt very-low income children more than other children, but the confidence intervals are large.

I also repeated the estimates shown in Tables 1 and 2 substituting state dummy variables for region dummy variables. In Model 2 the effect of the between-tract income variance is 1.876 with state dummy variables, which is similar to the 1.768 found with region dummy variables.[13] The effect of within-tract variance is 1.846 with region dummy variables but only -.479 with state fixed effects. This strengthens the conclusion that within-tract inequality has little effect on educational attainment. However, the standard errors are very large in the model with state fixed effects so the coefficients are not statistically significant at even the .10 level.[14] The difference between β_b and β_w is not statistically significant in either model. Thus the conclusion that economic inequality but not economic segregation affects overall educational attainment holds in both models.

I repeated the models in Tables 1 and 2 substituting segregation between school districts for segregation between census tracts. Again the results are substantively the same. In all models the coefficient for between-district income variance is about the same or greater than the coefficient for within-district variance, and the coefficients for between district variance and within-district variance are positive for high-income children and negative for low-income children. β_w is significantly smaller than β_b in models for high-income but not low-income children. The effects are also roughly of the same magnitude regardless of whether I use census tracts or school districts. For example, in Model 1 for the total sample, the coefficient for between-district income variance is 2.900 and the coefficient for within-district variance is 1.667, compared to 2.620 and 2.391 respectively in the same model using census tract data.

Because the effect of the variance between tracts is greater than the effect of the variance within tracts, these results seem to support the political economy hypothesis about the relationship between economic segregation and educational attainment. Low-income children

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[13] Model 2 is probably the right model to compare because it controls the most state-level characteristics but does not control parental income, which is not entirely exogenous.

[14] The story is similar when I re-estimate models for children in the top and bottom half of the income distribution. In Model 1 for the top half of the income distribution the effect of between-tract income variance is 3.968 in the model with state dummy variables compared to 3.561 with region dummy variables. For the bottom half of the income distribution, the effect of the variance of mean neighborhood income is –2.435 in the model with state dummy variables compared to –2.660 in the model with region dummy variables. However, the standard errors of the estimates are large in models with state dummy variables so these estimates are not statistically significant. The only difference between the model with state dummy variables and region dummy variables is the effect of within-tract income variance for low-income children. In the model with region dummy variables this coefficient is .096 with a very small t-statistic compared to –8.192 in the model with state dummy variables. This coefficient is significant at the .10 level. The conclusion that economic segregation reduces low-income children's educational attainment holds for both models.

living in states with a lot of economic homogeneity within neighborhoods do no worse than low-income children living in otherwise similar states with a lot of economic heterogeneity within neighborhoods.

IV. Conclusions

These results suggest that the increase in economic segregation between 1970 and 1990 had no effect on overall educational attainment. This is mainly because an increase in segregation raised educational attainment among high-income children by about the same amount that it reduced educational attainment among low-income children. Thus the increase in economic segregation increased inequality in educational attainment between rich and poor children.

The effect of segregation on educational attainment is mainly due to inequality in mean neighborhood income and not to inequality among neighbors in the same neighborhood. This could be because the benefits and liabilities of advantaged neighbors roughly cancel out, leaving little effect of within neighborhood economic inequality. It is also possible that effect of economic segregation on educational attainment has little to do with local interpersonal comparisons and more to do with school financing and other factors that can be influenced by competition between low-income and high-income neighborhoods. The results in this paper suggest that living in a state in which the average neighborhood has more income inequality has little affect on children's educational attainment. This does not necessarily mean that neighborhood economic inequality has no affect on children's educational attainment. Additional research that looks specifically at the effect of within neighborhood inequality is needed to test this hypothesis.

If economic segregation improves the well-being of affluent children, the rich are likely to segregate as they get richer. If they do and the increase in segregation exacerbates the gap in educational attainment between rich and poor children, economic segregation in one generation will contribute to economic inequality in the next generation.

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Appendix
Description of the Data and Variables

PSID Data

I use data from the 1993 wave of the PSID. PSID variables were constructed by pooling across the 26 currently available waves of the PSID Family File (years 1968 through 1993).The sample includes all respondents who were ages 23 through 37 in 1993 and who are not missing data on independent variables. I weighted the observations to account for the PSID sample design. I assigned values to each individual based on that individual's age rather than a particular year. For example, I average family income when children were aged twelve to fourteen. Thus it was averaged over 1985 to 1987 for children born in 1973 and over 1990 to 1992 for children born in 1978. Following is the description of the variables created with PSID data. The means and standard deviations of all variables are in Table A1.

Years of Schooling is the number of years of schooling that a respondent reported having completed when he or she was twenty-three years old.

Log Family Income is the natural logarithm of a household's cash income averaged over the three years when the child was age twelve through fourteen. All income values are in 1998 dollars using the CPI-U-X1 price adjustment.

Parental Education is the highest year of schooling completed by the mother as reported when the child was aged fourteen. If this was missing, I use the mother's education when the child was age thirteen and so on until age eleven. If all of these values were missing, then I assigned the father's education when the child was age fourteen.

African American: A dummy variable set equal to 1 if the child was African American, 0 otherwise.

Census Data

Most of the state level variables used in this analysis come from the 1970, 1980, and 1990 Public Use Microdata Sample (PUMS) of the U.S. Census. In 1980 and 1990 I used the 5 percent samples. In 1970 I use the 1 percent sample because that is what is available. Because state-level data is attached to individual cases, the means and standard deviations of state-level variables reported in tables are approximately weighted by the state population. For all variables computed with census data, I use linear interpolation for the inter-census years and assign values for the year win which a child was fourteen years old.

State Mean Household Income was computed by summing the components of income for each person in a household. Using components of person's income rather than person's total income increases the detail available at the upper tail of the income distribution by avoiding Census Bureau top-coding of total household income. To limit the detrimental effect on comparability of changes in the Census Bureau's top-coding of income components, we created uniform income components and top-codes that we used in all years. Variables are top-coded by reassigning values above the lowest 99th percentile of positive values among the years to the median of all values across years that lie above that lowest 99th percentile. The same was done for negative values using the highest 1st percentile as the cutoff. All dollars are adjusted to1998 dollars using CPI-U-X1. The resulting components are then summed to get household income. Persons in group quarters were excluded from all calculations.

State Percent African American and Percent Hispanic. I estimate these variables using 1970, 1980, and 1990 PUMS data.

Returns to Schooling for individual *i* in state *s* and year *y* is estimated for workers aged eighteen to sixty-five years using the following model:

$$\ln W_{isy} = \beta_0 + \beta_s S_{is} + \varepsilon_{is}$$

where *S* is the individual's schooling. In this model β_s is the percentage increase in wages due to an additional year of schooling. I experimented with twelve different measures of returns to schooling, using different age groups, different functional forms, and separating returns for men and women. I use the measure that increased R^2 the most when added to the estimation model. This measure also corresponds best to economic theory about the functional form of returns to schooling and produces an estimated return to schooling that is consistent with previous research (Winship and Korenman 1999, Mayer and Knutson, Ceci 1991).

Decomposition of Income between Census Tracts. I begin with the variance of total household income in a state calculated from the PUMS data described above. Next I compute the mean household income of each census tract using data from the STF4 file in 1970 and the STF5 file in 1980 and 1990. In 1980 and 1990 I divide the aggregate household income of the tract by the number of households in the tract. I weight mean tract income by the number of households in the tract and calculate the variance of mean tract income. This is the *between tract variance of income*. The *within-tract variance of income* is the total variance of income less the between tract variance.

Not all the geographic areas of states are grouped into census tracts. The proportion of the population in census tracts in a state increased over time as states both increased population and as the population became more concentrated. The number of census tracts changed over time both because new tracts were created and because the boundaries of old tracts changed. The number of tracts increased from 34,026 in 1970, to 41,925 in 1980 to 48,187 in 1990. I use all the tract data available in a year, rather than using a consistent definition of tracts because the growth in census tracts largely reflects growth and concentration of population. I estimate the mean income for the state population not living in census tracts and treat that area like a "super census tract." That is for the purpose of computing the between tract variance I treat the weighted mean of the untracted area as a census tract. This allows the within and the between tract variance of income to exactly sum to the total variance of income for the state. Because I weight by state population, states with higher proportions of their residence living in census tracts get high weights and those living in less populous states get lower weights. There was no tract level data available for Vermont or Wyoming in 1970 and these states are omitted from all analyses.

Table A1 Correlations among Variables

	1	2	3	4	5	6	7	8	9	10
1. Years of Schooling	1.00									
2. Mean Household Income/$1,000	.106	1.00								
3. Percent African American	-.305	-.080	1.00							
4. Percent Hispanic	.369	.055	-.135	1.00						
5. Child's Race is Black	-.144	-.124	.342	-.013	1.00					
6. State Between-tract Variance/10,000	.109	.760	-.014	.615	-.023	1.00				
7. State Within-Tract Variance/10,000	.111	.821	-.249	.342	-.104	.562	1.00			
8. Log Household Income	.263	.359	-.208	.120	-.374	.207	.231	1.00		
9. Parent's Education	.364	.240	-.250	.104	-.247	.150	.241	.425	1.00	
10. State Unemployment Rate	-.071	-.032	.083	-.044	.029	-.023	.030	-.032	-.101	1.00
11. State Returns to Schooling	.046	-.003	.502	.325	.137	.350	.234	-.003	-.059	-.075
Mean	12.906	36.728	11.460	4.971	.155	.256	.837	10.759	11.431	8.788
Standard Deviation	2.121	4.526	7.744	6.170	.362	.118	.113	.657	2.661	(2.341

Source: See date description above.

Table A2, Effect of within-tract Income Variance and between-tract Income Variance on Years of Schooling

Model and Variables	Model 1	Model 2	Model 3
Between Tract Variance/10,000	2.620	1.769	1.422
	(2.632)	(1.638)	(1.485)
Within Tract Variance/10,000	2.391	1.846	.975
	(2.384)	(1.890)	(1.066)
State Mean Income/10,000	-.076	-.060	-.076
	(-2.415)	(-1.894	(-2.602)
State Percent African American	-.014	-.019	.009
	(-1.611)	(-1.929)	(1.000)
State Percent Hispanic	-.013	-.018	-.011
	(-.888)	(-1.132)	(-.842)
State Unemployment Rate		-.045	-.022
		(-2.267)	(-1.130)
State Returns to Schooling		23.716	10.556
		(2.155)	(1.005)
Log Household Income in 1998 dollars			.788
			(10.728)
Parents' Years of Schooling			.201
			(10.433)
Child is African American			.016
			(.138)
R^2	.033	.037	.193

Source: PSID sample described in Appendix.
Note: Models control region and year dummy variables. T-statistics are in parentheses.

Table 1, Effect of Economic Segregation on Years of Schooling

Model and Variables	Between Tract Variance	Within Tract Variance	Difference ($\beta_b - \beta_w$)
Model 1 Controlling Mean Income, Percent African American and Percent Hispanic	2.620 (2.632)	2.391 (2.384)	.229
Model 2: Adding State Returns to Schooling and Unemployment Rate	1.769 (1.638)	1.846 (1.890)	-.077
Model 3: Adding Parent's Education, Family Income, and Child's Race	1.422 (1.485)	.975 (1.066)	.447

Source: PSID sample described in Appendix.
Note: Estimates are from an OLS regression that control region and year dummy variables. T-statistics are in parentheses.

Table 2, Effect of Economic Segregation on Years of Schooling by Family Income

Model and Variables	Between Tract Variance	Within Tract Variance	Difference ($\beta_b - \beta_w$)
High Income Children			
Model 1: Controlling Mean Income, Percent African American and Percent Hispanic	3.876 (3.072)	2.535 (1.949)	1.341
Model 2: Adding State Returns to Schooling and Unemployment Rate	3.561 (2.656)	2.037 (1.542)	1.748
Model 3: Adding Parent's Education, Family Income, and Child's Race	3.777 (2.964)	1.076 (.889)	2.701*
Low Income Children			
Model 1: Controlling Mean Income, Percent African American and Percent Hispanic	-1.475 (-1.111)	-.013 (-.009)	-1.462
Model 2: Adding State Returns to Schooling and Unemployment Rate	-2.660 (-1.812)	.096 (.064)	-2.756*
Model 3: Adding Parent's Education, Family Income, and Child's Race	-2.697 (-1.888)	-.497 (-.326)	-2.200*
Very Low Income Children			
Model 3	-3.317 (-1.299)	.592 (.230)	-3.909

Source: PSID sample described in Appendix.

Note: Estimates are from an OLS regression that control region and year dummy variables. T-statistics are in parentheses. Low-income children are in the poorest half of the income distribution. High-income children are in the richest half of the income distribution. Very low-income children are in the poorest 25 percent of the income distribution.

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